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FOREST TREE IMPROVEMENT IN CALIFORNIA--1970

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Abstract: Foresters in California were surveyed in 1970 to determine the extent of artificial regeneration and tree improvement efforts in the State. Seeding of Douglas-fir was the prevailing practice in the North Coast. Inland areas were being planted with conifers, including ponderosa, Jeffrey, Monterey, and sugar pines, Douglas-fir, and red and white firs. Manpower devoted to tree improvement programs amounted to 8.7 man-years. It was being used chiefly to select superior trees and to establish seed orchards of Douglas-fir and ponderosa and sugar pines. These tree-improvement efforts fall far short of that required to study and improve California's timber resources.

Oxford: 232.311.2/.3: 174.7 *Pinus* spp. (794) [+ 174.7 *Abies* spp. (794) + 174.7 *Pseudotsuga menziesii* (794)].
Retrieval Terms: tree improvement; *Pinus ponderosa; Pseudotsuga menziesii; Abies* spp.; California; artificial regeneration; superior trees; seed orchards.

Timber harvesting in California is centered on old-growth stands. Regeneration methods rely largely on natural seeding. Artificial regeneration through seeding or planting is of secondary importance. This emphasis has tended to slow progress in tree improvement work in the State.

To find out what needs to be done to strengthen this work, the Forest Tree Improvement Committee, Northern California Section, Society of American Foresters (SAF) conducted a survey of foresters in California.[1] The survey was designed to determine the (a) scope of artificial regeneration efforts in California's forest lands, including species being used; and (b) amount of manpower committed to tree improvement work. This note summarizes the main findings of the survey.

TIMBER REGIONS

California has two major timber producing regions, both north of a line between Monterey Bay and Walker Pass: The North Coast Region is west of the Coast Ranges crest and the Interior Region east of it. Timber species and management practices differ between these two regions. In the North Coast Region, Douglas-fir *(Pseudotsuga menziesii)* and redwood *(Sequoia sempervirens)* are the principal species. In the Interior region, the main timber species are Douglas-fir, yellow pines (ponderosa [*Pinus ponderosa*] and Jeffrey [*P. jeffreyi*]), true firs (white [*Abies concolor*] and red [*A. magnifica*]), and sugar pine *(P. lambertiana)*.

Most of the timber harvested is used to produce lumber (86 percent) or veneer and plywood (10 percent). Barrett, *et al.*[2] reported that about 80 percent of the logs consumed for lumber were from old-growth timber. Old-growth timber accounted for 95 percent of log consumption in the production of veneer and plywood.

FOREST REGENERATION

Natural regeneration is by far the predominant regeneration method accompanying the old-growth harvest, but considerable acreages are seeded or planted. The SAF survey showed that 53,767 acres were artificially regenerated in 1970 *(table 1)*. This acreage is about 5,000 more than that artificially regenerated in California from July 1, 1968, to June 30, 1969. During that period, about 12,900 acres were directly seeded,[3] and forest nurseries produced 21.6 million trees for regeneration.

The increase in artificial regeneration 1970 can be attributed to the effort in direct seeding in the North Coast area. The value of 17,402 acres devoted to Douglas-fir regeneration includes some acreage seeded with species mixes. The mixes were predominantly Douglas-fir with coast redwood, Sitka spruce *(Picea sitchensis)*, Port-Orford-cedar *(Chamaecyparis lawsoniana)*, Monterey pine *(Pinus radiata)*, and occasionally ponderosa pine added in various ratios, depending upon the site to be regenerated and the likelihood of establishment success. In the North Coast Region, the major emphasis was on direct seeding (94 percent of the 19,622 acres regenerated).

Statistics from the Interior Region contrast with those from the North Coast. In the Interior, ponderosa pine and Douglas-fir dominate the regeneration

Table 1 – *Acres artificially regenerated in the two major timber-producing regions of California, 1969-1970*

Species	North Coast Area			Interior Areas			Statewide	
	Direct seeding	Planting	Total	Direct seeding	Planting	Total	Total	Percent
Douglas-fir	[1]17,402	735	18,137	700	10,211	10,911	29,048	54
redwood (coast)	280	7	287	0	0	0	287	--
Sitka spruce	258	0	258	0	0	0	258	--
Monterey pine	365	0	365	100	1,330	1,430	1,795	3
Port-Orford-cedar	204	0	204	0	0	0	204	--
bishop pine	5	119	124	0	0	0	124	--
ponderosa pine	0	247	247	100	12,790	12,890	13,137	24
Jeffrey pine	0	0	0	0	6,200	6,200	6,200	12
red fir	0	0	0	70	790	860	860	2
white fir	0	0	0	40	535	575	575	1
sugar pine	0	0	0	395	446	841	841	2
Coulter pine	0	0	0	0	200	200	200	--
giant sequoia	0	0	0	10	110	120	120	--
knobcone – Monterey hybrid	0	0	0	0	93	93	93	--
Jeffrey – Coulter hybrid	0	0	0	0	25	25	25	--
Total	18,514	1,108	19,622	1,415	32,730	34,145	53,767	--
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*		
Percent, by area	94	6	100	4	96	100	--	--

[1]The acreage represented though predominantly Douglas-fir includes a mixture of redwood and Sitka spruce. Occasionally Monterey pine, Port-Orford-cedar, and ponderosa pine make up a small portion of the mix. Data from the survey did not allow for a further breakdown of the acreage, by species.

picture; Jeffrey pine ranks third, with about one-half the acreage of ponderosa pine. True firs (red and white) along with sugar pine and Monterey pine make up the remainder of the effort. In the Interior area, 96 percent of the 34,145 acres regenerated were planted.

The statewide totals show Douglas-fir dominating the over-all effort, followed by the yellow pines, then Monterey pine, the true firs, and sugar pine. On a statewide basis, 63 percent of the regeneration was by planting, 37 percent was by seeding.

MANPOWER DEVOTED TO TREE IMPROVEMENT

For purposes of the survey, manpower included all persons working in the area of source verification of wild seed, involved in plus tree selection, and developing seed production areas and seed orchards. The values reflect only the personnel on the ground and do not include supervisory or advisory personnel.

Statewide totals had 8.7 man-years involved in tree improvement efforts. About one-half of that total (4.4 man-years) were persons involved in the U.S. Forest Service's ponderosa pine improvement program. The program is concerned with selecting superior trees and developing clonal seed orchards.

The second greatest manpower effort was being placed on Douglas-fir. About 1.3 man-years were used in the improvement of Douglas-fir, with grafting into clonal seed orchards the principal activity.

Ranking near the effort put into Douglas-fir was work in sugar pine. A sugar pine improvement program carried out by the Forest Service has resulted in the identification of parent trees carrying genes for resistance to white pine blister rust.[4] The program combined a search for additional parents carrying the genetically conditioned resistance with a search for phenotypically superior parents. Both types of parents were being grafted into seed orchards.

Some effort was placed on trees for special purposes. Both State and Federal agencies are producing the knobcone X Monterey pine *(Pinus attenuata* X *P. radiata)* hybrid for dry, low-elevation sites. The combined effort is estimated at 1.1 man-years for 1970, with most of it directed toward the controlled pollinations required for seed production.

A similar situation existed for the backcross of Jeffrey parents to Jeffrey-Coulter *(Pinus jeffreyi* X *P. coulteri)* hybrids, a special-use hybrid for sites difficult to regenerate. About 0.5 man-years was involved in the selection of parents and the production of hybrid seed.

The remainder of the manpower for tree improvement in California was involved primarily in seed source verification of various species, namely white fir, red fir, redwood and Monterey pines. Answers to our questionnaire anticipated an increase in manpower. In the interim, three new positions have been established with full time responsibility for tree improvement. One person has been added to the State's Division of Forestry and two have been added to the Forest Service. These additions bring the total effort to about 12 man-years—the figure previously estimated from the survey.

DISCUSSION

Species diversity is a characteristic of California forests as reflected in statistics for 1968.[2] Volume consumption showed Douglas-fir ranking first, with 32 percent; true firs, 22 percent; redwood, 18 percent; ponderosa pine, 16 percent; sugar pine, 8 percent; and the remainder, 4 percent, principally incense-cedar *(Libocedrus decurrens),* western hemlock *(Tsuga heterophylla),* spruce *(Picea),* lodgepole pine *(Pinus contorta),* bishop pine *(Pinus muricata),* and hardwoods.

Numerous species lead to diversity in utilization, regeneration, and management. The contrast between seeding and planting for the North Coast and Interior areas is readily apparent. This situation tends to work against large-scale, common-interest programs. Whereas the timber industry is oriented toward Douglas-fir in Washington and Oregon and southern pines in the southeastern United States, timber users in California do not share a common set of problems.

First improvement efforts in California have been directed toward seed source certification[5] and seed production area establishment. The use of local or proven stock is becoming common practice. Some natural stands have been rogued to leave the best trees for seed production. The creation and maintenance of seed production areas was emphasized in the Forest Service's tree improvement program.[6] Survey data indicated that 9 percent of the ponderosa planting stock was from seed obtained from seed production areas. The availability of seed from select parent trees in seed orchards is still in the distant future.

Direct seeding in the North Coast area was noticeably on the increase. The increase was attributed to a California law calling for guaranteed regeneration on clearcut lands. For many areas of the North Coast, the environment is favorable for natural regeneration, and direct seeding acts as insurance for regeneration. In some instances, seeding provides protection against

loss of timber sites to low-quality hardwoods.

But direct seeding is not without problems. Two are notable. One is that the control of stocking is difficult, and stand improvement costs for replanting or thinning may eventually outweigh the reduced costs associated with seeding. Another is the quantity of seed required for direct seeding. Survey results showed Douglas-fir being seeded at the rate of 0.5 to 1 pound to the acre. Douglas-fir seed crops are uncertain in California, and as Passof[7] points out, "Should [large-scale direct seeding] continue, seed reserves will rapidly deplete to the point where the rate per acre must be reduced to a bare bones minimum." Although 1971 promised to be a good seed year for Douglas-fir in the North Coast area, losses to cone and seed insects were heavy and seed collection was mediocre. A direct result of seed reserve depletion is that users accept more distant seed sources or do not plant at all. With the high cost of site preparation, the option of using nonlocal seed is usually adopted.

The difference between quantities of seed required by direct seeding and by planting is important in planning tree improvement programs. Forest Service estimates show that 1 pound of Douglas-fir seed will regenerate 27 acres when planted compared to 1 acre when seeded. Consequently, tree improvement programs are, by virtue of seed costs, universally directed to planting rather than seeding.

CONCLUSIONS

The current tree improvement manpower falls far short of that required to study and improve Californis's timber resources. The survey committee sensed a need for expanding knowledge of native species. Ecological studies, working out complex interrelationships between plants and animals within specific environments, are scarce. Information concerning the magnitude of genetic variability within commercial tree species is weak, at best, and virtually nonexistent for several of the most important. Sound data on the consequences of using nonlocal seed is notably lacking. The silvicultural management of various species lack adequate information on stocking levels, young-growth management practices, and stand improvement techniques—all of which influence the expression of genetic potential.

NOTES

[1] Members of the Survey committee were: William J. Libby, chairman; Ronald S. Adams, John M. Buck, M. Thompson Conkle, Eugene A. Hofsted, and Peter C. Passof. They thank the many foresters who provided the information summarized in this note.

[2] Barrett, B. R., D. R. Gedney, and D. D. Oswald. *California timber industries – 1968 – Mill characteristics and wood supply.* Calif. Div. For., Sacramento, Calif. 117 p. 1970.

[3] U.S. Forest Service. *1969 report of forest and wind-barrier planting and seeding in the United States.* U.S. Forest Serv., Coop. Forest Manage. Div., State and Priv. For. Washington, D. C. 13 p. 1969.

[4] Kinlock, Jr., Bohun B., Gaylord K. Parks, and Carl W. Fowler. *White pine blister rust: simply inherited resistance in sugar pine.* Sci. 167: 193-195. 1970.

[5] Buck, John M., Ronald S. Adams, Jerrold Cone, M. Thompson Conkle, and others. *California tree seed zones.* Calif. Region, U.S. Forest Serv., San Francisco, Calif. and Calif. Div. For., Sacramento, Calif. 5 p. 1970.

[6] Parks, Gaylord K., and John M. Buck. *Tree improvement program–1969.* Calif. Region, U.S. Forest Serv., San Francisco, Calif. 32 p. 1969.

[7] Passof, Peter C. *What's happening in. . .Mendocino County forestry.* Univ. Calif. Agric. Ext. Serv., Berkeley, Calif., and U.S. Dep. Agric. 2 p. 1970.

The Author

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